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A Survey of Home Appliances and Toilets in the Jordanian Markets

A Study Presented To

Academy for Educational Development

Water Efficiency for Public Information and Action (WEPIA) Program

Prepared By

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August 2004

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ABSTRACT

A successful approach that has been implemented in advanced countries to promote water and power use efficiency is labeling/rating programs targeting both appliances that utilize these two resources. Those programs are usually administered and monitored by governments and national bodies and aim at categorizing all appliances according to their efficiency, mainly in terms of energy and water consumption. The programs are usually continuous and their findings updated regularly. The results of those programs are made available to the public (consumers) with the purpose of educating the consumer on how energy/water efficient the product is and the amount of electricity/water used to run the appliance and to provide a common basis for comparison between products. Labeling programs usually cover all types of electricity and water consuming appliances. With no such programs implemented in Jordan, the overall objective of the study at hand was to document actual Jordanian market's data as it relates to appliances' efficiency. Specific objectives included the identification of the most efficient water and electric energy consumption for domestic appliances throughout the Kingdom, and the conduct of electric energy and water audits for as many domestic appliances usage as possible. The study covered four types of appliances; washers, dishwashers, water heaters, and toilet tanks.

Although not a comprehensive labeling assessment, the approach of the survey at hand resembles labeling assessments conducted worldwide. Generally, the survey revealed that there is a wide range of brands and models, of the appliances studied, available to the Jordanian consumers. Furthermore, this range included a variety of efficient and non-efficient appliances. In other words, the Jordanian potential buyer does have the option of selecting an efficient appliance shall s/he be presented with results of local studies similar to this one. The actual consumer behavior, however, was difficult to assess in this study. This is simply because the majority of interviewed importers declined to furnish any data related to their sales volumes. To make things worst, and although not always the case, the less efficient appliances had a tendency of being less expensive, which is the trend, worldwide. This in a way triggers consumers to purchase the less efficient brands and models. So, the consumers' negligence of the wide potential differences between models (in terms of operational cost) coupled with cost issues often drives a potential buyer to select the less expensive appliance.

The study at hand has shown that efficient appliances are available in the Jordanian markets, and in a wide variety. It is the government's responsibility to make consumers aware of this, in order to promote the purchase of more efficient appliances, thus encourage manufacturers and importers to become more selective about the efficiency of their products. Therefore, one of the medium term (3 to 4 years) recommendations is for the Government of Jordan (GoJ) to adopt a similar survey on a larger scale where ALL data are obtained from the public and private sources, including sales volumes. To do so, the government would have to coordinate with the importers to furnish sound and comprehensive technical and financial details about their products. Any programs adopted by the government should include all types of electric appliances and not only the ones addressed in this study. It is also recommended that the GoJ establish a Public-Private sector partnership to promote the labeling concept. The success of the US Energy Star program lies in the strong public-private partnership. Potential partners include universities, NGOs, professional associations, Royal Scientific Society, etc.

Until an official labeling policy is adopted by the GoJ, the study team recommends that the WEPIA project coordinate with the Consumer Protection Agency to issue a simple general interim label that can be distributed to the importers and dealers of the brands that were found to be efficient in this survey. The label could be similar to previous stickers and labels that WEPIA has produced to promote the use of Water Saving Devices and would give an indication to the potential consumer that this product is one of the most efficient products available on the Jordanian markets. A rough schematic of such label is shown in Figure 9 below. The study team recommends that the "Abu Tawfeer" character developed by the WEPIA project be utilized due to Jordanians' familiarity with it. It would be the Consumer Protection Agency's responsibility, however, to guarantee that only appliances identified as efficient in this study be authorized to use such label.

1.0 INTRODUCTION

Water is considered to be the most valuable of all resources in the Middle East, especially in Jordan, which is one the poorest ten countries in terms of water availability and the per capita water share. Power, especially electric power, has also become a vital commodity that is necessary to keep up with the lifestyle and technology advancements, worldwide. Unfortunately, both water and electricity can be limited in some countries. Over the years, this fact has triggered governments, policy makers, and international entities to design, develop, and implement programs and projects focusing on measures and practices for the management and of water and electric power. Demand management has become a widely applied concept in many areas such as Traffic Demand Management, Power Demand Management, and Water Demand Management, just to name a few. The concept of demand management has helped many countries cope with the limited availability of such elements by optimizing demand and minimizing waste.

Over the years, and as a result of the advancement in lifestyles, home appliances have evolved from simple machines to highly advanced technological instruments. Today, home appliances are widely used, are mostly electricity operated, and many of them involve the usage of water such as washers, water heaters, and dishwashers. Considering the limited availability of water and electricity in some countries, it has become necessary to utilize home appliances that are both water and energy efficient. In addition to preserving such important commodities, the utilization of efficient technology has the benefit of reducing the cost incurred by the appliance owner.

One successful approach that has been implemented in advanced countries is labeling/rating programs targeting both water and energy consuming appliances. Such programs are usually implemented by governments and national bodies and aim at categorizing all appliances according to their efficiency, mainly in terms of energy and water consumption. The programs are usually continuous and their findings updated regularly. The results of those programs are made available to the public (consumers). When looking to buy an appliance, many people compare the size, features, cost and running cost of the appliance. The Energy and/or Water Rating label acts as an efficiency indicator – telling the potential buyer how energy/water efficient the product is and the amount of electricity/water used to run the appliance to provide a common basis for comparison between products. Labeling programs usually cover all types of electricity and water consuming appliances. Those programs have proven their success in terms of energy and water savings. For example, the U.S. ENERGY STAR program, that will be introduced in more detail in a following section has successfully delivered energy and cost savings across the U.S. exceeding $9 billion a year. The EU's ENERGY STAR program that will also be presented in a following section is expected to account for electricity savings of about 10 TWh per year by the year 2015. Finally the Australian Water Efficiency Labeling scheme is expected to save nearly 610,000 megalitres of water by the year 2021.

Unfortunately, such programs have never been implemented in Jordan. It is believed that if such a comprehensive program can be adopted by the Government of Jordan (GoJ), and is complemented by a national strategy to increase people's awareness on the concept and results of water and energy labeling, it would promote the use of the most energy/water efficient appliances, thus, result in significant savings in water and energy. In addition, such policy would increase the sense of competition among local and foreign manufacturers, and importers of such

appliances, which will drive the manufacturers to produce more efficient products, and at lower costs to the consumers. Other advantages of such programs include environmental benefits such as reducing green house gas emissions, water availability, water quality, etc.. Therefore, buyers who purchase a more efficient product will also contribute to the reduction of environmental hazards resulting from certain appliances.

The report at hand presents the findings of a study conducted in Jordan that addressed the issue of energy and water consumption for certain appliances available in the Jordanian markets. The survey aimed at categorizing the various brands of appliances according to efficiency to determine the most efficient brands. This study does not attempt to replace a highly recommended national comprehensive strategy, however, it intends to demonstrate the levels of variation among the various appliances available on the Jordanian markets, thus, indicate the importance of launching a well controlled labeling and/or rating program addressed at appliances in Jordan.

2.0 OBJECTIVE

The overall objective of this work was to document actual Jordanian markets' data as it relates to appliances' efficiency. The results were to be presented in a manner that would enable consumers to compare the water and energy consumption efficiency of domestic appliances on a fair and equitable basis and to choose the most efficient appliance with minimum operating costs.

The specific objectives of this work are as follows:

1. Identify the most efficient water and electric energy consumption for domestic appliances throughout the Kingdom,
2. Conduct electric energy and water audits for as many domestic appliances usage as possible, and

3.0 LITERATURE REVIEW

3.1 Background on Labeling Programs

Energy and water labeling programs are implemented in many countries around the world. Although they may be given different names, are applied to different appliances, and address different resources, they all have the same concept and objectives; which is to provide consumers with information, influence consumer purchase decisions by encouraging them to purchase the most efficient appliances, and influence manufacturers to manufacture more efficient products. Successful rating and labeling programs have been implemented in Europe, U.S., Australia, Korea, Japan, Canada, Mexico, and the Philippines, just to name a few. The following sections present some of those programs.

3.1.1 Energy Oriented Labeling Programs

3.1.1.1 USA

In 1992, the US Environmental Protection Agency (EPA) introduced the ***ENERGY STAR*** as a voluntary labeling program designed to identify and promote energy-efficient products to reduce greenhouse gas emissions. Computers and monitors were the first labeled products. Through 1995, EPA expanded the label to additional office equipment products and residential heating and cooling equipment. In 1996, EPA partnered with the US Department of Energy for particular product categories. The ENERGY STAR label is now on major appliances, office equipment, lighting,

home electronics, and more. EPA has also extended the label to cover new homes and commercial and industrial buildings.

Through its partnerships with more than 8,000 private and public sector organizations, ***ENERGY STAR*** delivers the technical information and tools that organizations and consumers need to choose energy-efficient solutions and best management practices. ***ENERGY STAR*** has successfully delivered energy and cost savings across the U.S., saving businesses, organizations, and consumers more than $9 billion a year. Over the past decade, ***ENERGY STAR*** has been a driving force behind the more widespread use of such technological innovations as LED traffic lights, efficient fluorescent lighting, power management systems for office equipment, and low standby energy use.

Recently, energy prices have become a hot news topic and a major concern for consumers in the U.S. ***ENERGY STAR*** provides a trustworthy label on over 40 product categories (and thousands of models) for the home and office. These products deliver the same or better performance as comparable models while using less energy and saving money. ***ENERGY STAR*** also provides easy-to-use home and building assessment tools so that homeowners and building managers can start down the path to greater efficiency and cost savings. Figure 1 shows a typical Energy Star label used in the U.S. Typical energy consumption structures for the different tiers in the rating system for some appliances are shown in the Appendix.

3.1.1.2 The European Energy Star Program

The **ENERGY STAR** Program was officially introduced in the European Community through two legislative acts: the Council Decision concerning the conclusion on behalf of the European Community of the Agreement between the Government of the United States of America and the European Community on the coordination of energy-efficient labeling programs for office equipment[1]; and the Regulation of the European Parliament and Council on a Community energy efficiency labeling program for office equipment and appliances.

As is the case in the U.S., ENERGY STAR is a label that helps consumers identify office equipment products that save them money and help protect the environment by saving energy. Manufacturers, assemblers, exporters, importers and retailers are invited to register with the European Commission allowing them to place the ENERGY STAR label on products that meet or exceed energy-efficiency guidelines – i.e. computers, monitors, printers, fax machines, copiers, scanners and multifunction devices. The basic objectives underlying the new EC program are firstly, to introduce in the Community the ENERGY STAR logo as a sign or marking as defined in the Agreement with the United States, secondly, to set the rules for its use and to prohibit its misuse and, thirdly, to establish the general rules and procedures for the

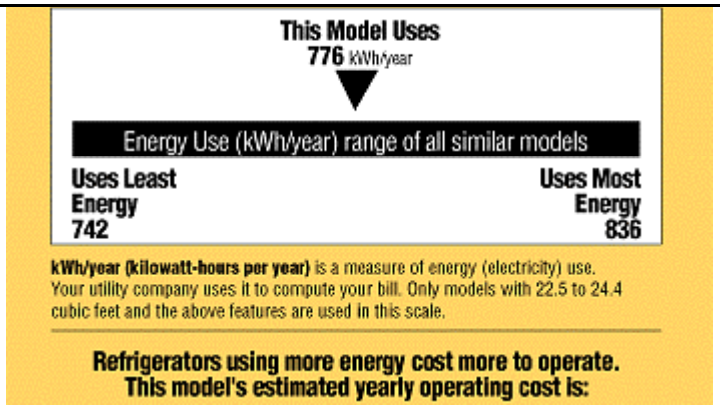


Figure 1. Typical Energy Star Label Used in the U.S.

implementation in the Community of the provisions of the Agreement. The participation in the program is on a voluntary basis only.

Office information and communication technology equipment is responsible for a large share of electricity consumption in the tertiary sector within the EU. Therefore, the ENERGY STAR program is expected to account for electricity savings of about 10 TWh per year by the year 2015 in a very cost-effective way and it shall maximize consumer and environmental benefits, by stimulating the supply of, and the demand for, energy efficient office equipment

To promote the concept, the Commission makes an effort to encourage consumer acceptance of products introduced under the ENERGY STAR Program and bearing the ENERGY STAR logo. The Commission also undertakes actions to promote energy-efficient equipment, and inform consumers about the ENERGY STAR Program and ENERGY STAR logo by writing articles and/or co-operating with the news media by sharing information, where appropriate. A list of ENERGY STAR Program Partners, including a description of their specific contribution to the ENERGY STAR Program is regularly published widely in the form of brochures, Internet sites, etc.

3.1.1.3 Australian's Leading Guide To Choosing An Energy Efficient Appliance

In Australia, an Appliance Energy Rating Label (AERL) is a scheme that is a joint initiative of the federal, state and territory governments. The AERL was first introduced in 1986 in New South Wales and Victoria. It is now mandatory in all states and territories The major categories of home appliances that are required to carry an energy rating label, include, Refrigerators, Freezers, Dishwashers, Washing machines, Clothes dryers, and Air conditioners. It is compulsory for manufacturers to put an Energy Rating label on every product.

The two key features of the AERL are that it:

- Rates the energy efficiency of the appliance on a scale of *one to six stars*. The more stars, the more energy efficient it is.
- Indicates how much energy the appliance uses in kilowatt-hours when tested to the relevant *Australian Standard*.

Manufacturers who produce/import appliances for the Australian market are required to submit their products to an approved testing agency. Testing is undertaken and the appliance's energy consumption and overall performance is determined. This testing information is used to calculate the appliance's hourly or manual kilowatt-hour

(kWh) and its corresponding star rating. Appliances must also conform to any relevant performance requirements in the relevant Australian Standard before they can be granted an Energy Rating label. Figure 2 shows a typical Energy Star label used in Australia.

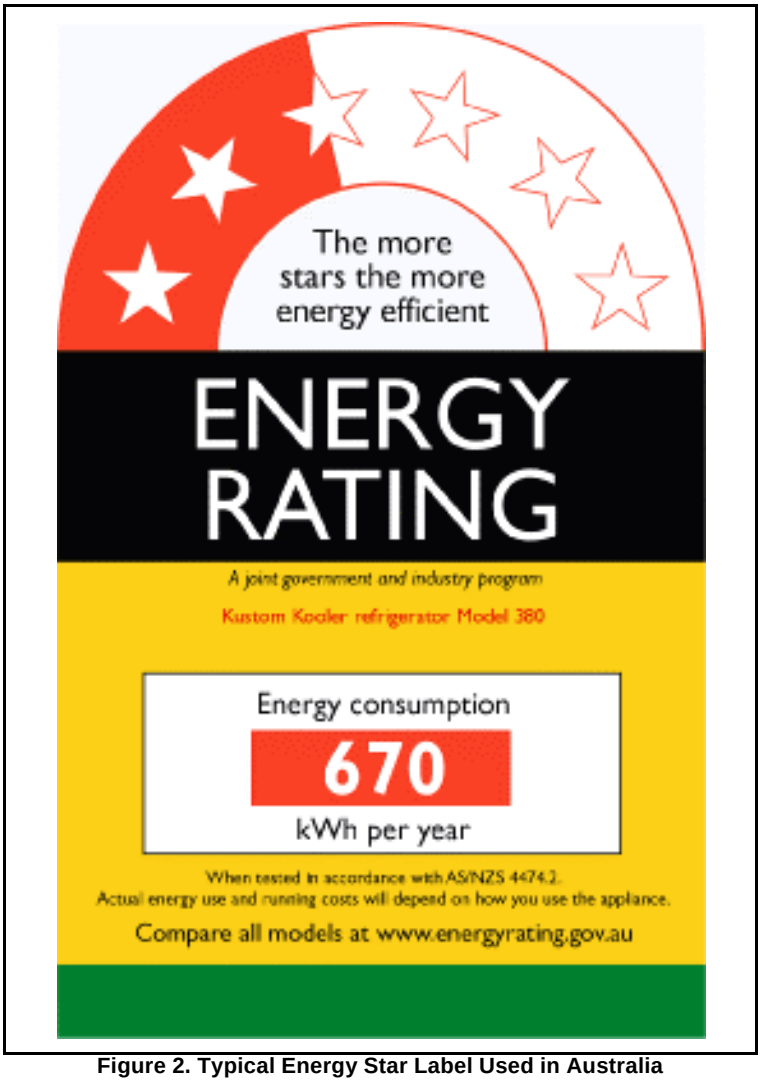


Figure 2. Typical Energy Star Label Used in Australia

3.1.1.4 Energy Rating in the UK

In the UK, The National Energy Foundation, a registered charity, developed the National Home Energy Rating Scheme for use on British homes developed the first commercially available Energy Rating system for use on British homes (i.e., not only on appliances). By 1994, the scheme had been so successful and grown so large that for legal reasons the Trustees of the Charity believed that it should be operated through a trading subsidiary company - National Energy Services Ltd.

Although similar in concept to the appliance rating schemes, energy rating for homes is quite simply a way of comparing the amount of fuel that would be used by different homes, assuming that the occupants live in them in the same way. A program is used to give each home a score, where higher numbers indicate more energy efficient homes that should be cheaper to run and easier to keep warm. The Government's own scoring system is called the Standard Assessment Procedure (SAP) on a scale from 1-120. In addition, the best energy labels will also quote:

- The National Home Energy Rating (NHER) on a scale of 0 to 10; and
- An estimate of the amount of carbon dioxide (CO_2 - the main greenhouse gas) emitted each year as a result of the home's energy use. The Government has produced a technical Carbon Index as one of the ways of satisfying the new (from 1 April 2002) Building Regulations in England and Wales.

The two energy scales measure slightly different things: the SAP looks only at the fixed elements of the home and is the same wherever the property is located in the UK. All homes built to the same design should have exactly the same SAP. The NHER includes various location-specific elements (including whether the home is South facing or sheltered from wind by other buildings) and so reflects actual running costs. If two homes have the same floor area but different NHERs, then the home with the better (higher) NHER should cost less to run.

In contrast, energy labeling of appliances is subject to various European Union directives and operates on a pan-European basis, with a common A-G energy labeling scale, where A represents the best appliances and G the worst, as shown in Figure 3.

Almost all UK homes are suitable for energy rating; at present EU energy labels are only available on some appliance types, including fridges, freezers, domestic ovens and washing machines. EU labels are also available for domestic heating boilers and these have been incorporated into an NHER software.

The Office of the Deputy Prime Minister (ODPM) has recently published a version of the above comparison chart. This shows how SAP Ratings *may* be compared to a simplified label system on a European **A-G** scale. The average UK home, which will have a SAP of around 46, falls into the **E** grade on the alphabetic scale.

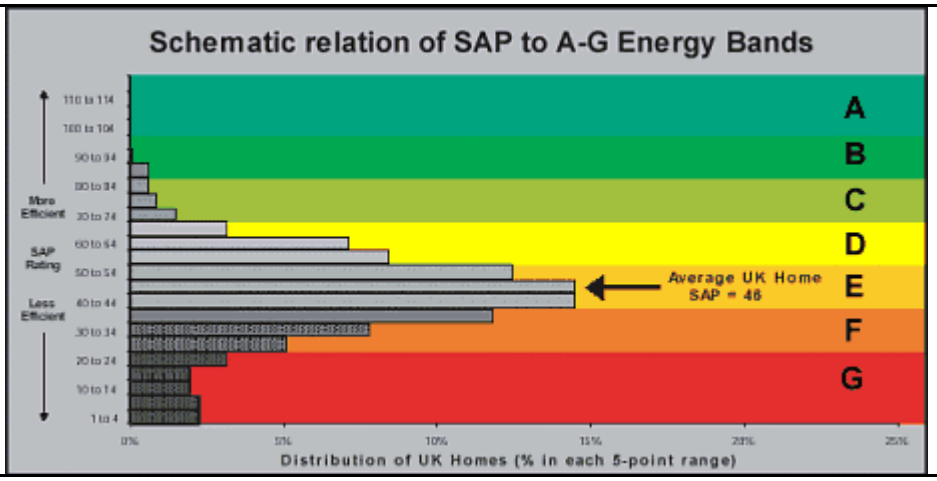


Figure 3. European Energy Ratings

3.1.2 Water Oriented Labeling Programs

Given the success of the EPA created ENERGY STAR program, the EPA began, in the summer of 2002, to investigate ways to enhance the market for water-efficient products as a potential program to respond to the growing demands placed on America's water supplies and water infrastructure systems. Since then, the EPA's Water Efficient Product Market Enhancement Program has conducting a series of stakeholder meetings to work toward approaches and partnership opportunities that promote water efficient products, including product labeling, modeled in part on the successful Energy Star Program. The results of the EPA's initial investigations and continued collaboration with state and local water officials, environmental organizations, and businesses have demonstrated many potential environmental, economic, and energy benefits of market enhancement programs for water efficient products. In July, 2003 over 100 such organizations expressed support for a national water-efficient product labeling program.

The EPA is still in the process of planning specific steps towards advancing a national, voluntary, market-based program for promoting water-efficient products. This has started through a series of meetings of key stakeholders. The first meeting was held in October, 2003 in Washington, D.C. , a second meeting was held in January, 2004 in Austin, a third meeting was held in Phoenix in February, 2004, and a fourth stakeholder meeting was held in Seattle in April, 2004.

The EPA's national program mainly seeks to increase water efficiency by:

- informing water users of the advantages of water-efficient products,
- motivating manufacturers to produce more water-efficient products, and
- encouraging distributors, retailers, and local water utilities to promote these products.

The types of products the EPA would consider evaluating could include plumbing products, appliances, and landscape irrigation devices, being careful to proceed in areas where there would be clear benefits beyond those from activities already under way, such as the Energy Star program or national plumbing standards. To date, over 400 public and private entities across the U.S. have registered as stakeholders to the proposed program. It is the stakeholders input that will enable the EPA to evaluate the best available information to choose and develop the most

cost-effective approaches for achieving the Agency goals of conserving water supplies and reducing water and wastewater infrastructure needs. A very important activity foreseen by the EPA is partnership building. Without support from a wide array of stakeholders, including manufacturers, retailers, water and wastewater systems, municipalities, states, consumer organizations, and environmental groups, a market enhancement program for water efficient products would not be viable and would not reach the level of success enjoyed by the Energy Star program.

In a 2003, a study commissioned by Environment Australia was completed. The purpose of the study was to examine the potential for, and impacts of, introducing a national mandatory water efficiency labeling (WEL) scheme and minimum water efficiency standards (WES) for appliances, fixtures and fittings as a method of reducing urban water consumption. Again, this investigation followed the successful National Appliance and Equipment Energy Efficiency Program (NAEEEP) mentioned before. The study examined program options for shower heads, toilets, clothes washers, dishwashers, taps, urinal flush and flow regulators.

In a press conference in August 2004, the Australian Minister of Environment and Heritage launched the scheme indicating that it would be phased in manner where by late 2005, six appliances will carry water efficiency labels: washing machines, dishwashers, toilets, showerheads, some types of taps and urinals, and would also set minimum water efficiency standards for toilets.

Unfortunately, both the U.S. and the Australian experiences in this regard are in their development phases, and no evaluation indicators are available at this time. However, the Australian government anticipates that by the year 2021 Australians will save nearly 610,000 megalitres as a result of this scheme alone.

3.2 Monitoring and Evaluation; Top Energy Saver Award (TESAW)

TESAW is a new award system that the Australian government has created to recognize the most efficient rated products on the market. It applies to both electric and gas products that carry a star rating energy label. It is an award system that helps consumers quickly identify the most efficient products on the market. The award is updated every year and the scheme replaces the previous Galaxy Award system.

There are separate TESAW labels for electric and gas appliances. For electric appliances, manufacturers have the option of including the TESAW award year in the green band at the bottom of the energy label (as shown in Figure). There are several versions of the TESAW labels, which can be affixed to appliances. Electrical products that are eligible for a TESAW Award may carry one of two labels, as shown in Figure 4.

Each year, government officials review the energy efficiency of all products on the market. In consultation with industry, they set minimum energy efficiency criteria (usually a minimum star rating) for TESAW awards for the coming year. From the start of the award period, manufacturers of existing products or new products that meet the minimum energy efficiency criteria are eligible to apply for an award. Once an award is granted, the manufacturer is eligible to display the TESAW label on their products in retail stores.

The TESAW label is an endorsement label - it is complementary to the normal star-rating label. If you find a product that carries a TESAW label for the current year, you can be sure that it is one of the most efficient models on the market at the moment.

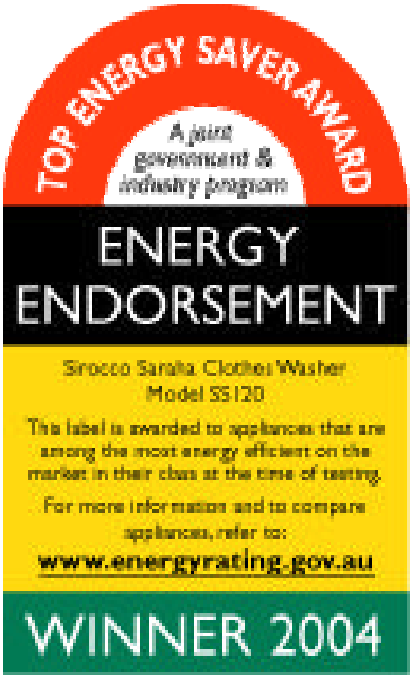
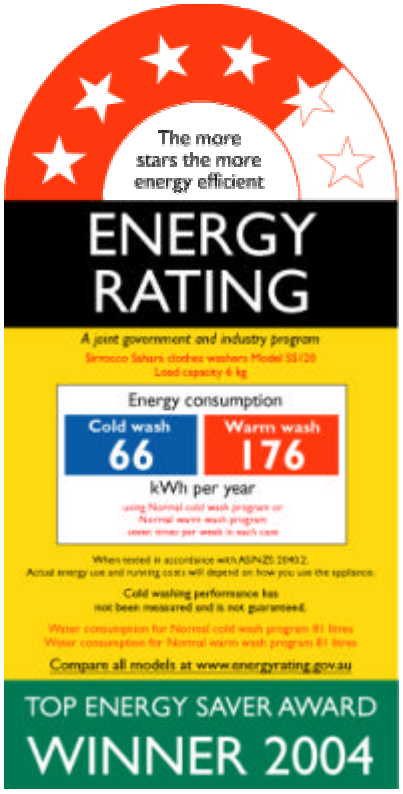
	The first is a specially designed TESAW label as shown here. The label is about half the size of a normal electric energy label and is in the same colors. This label should sit adjacent to the normal electric energy label.
	The second variation is where the TESAW Award and year are indicated in the green bar of the normal electric energy label.

Figure 4. TESAW Award Labels

To be eligible for a TESAW award, products must meet minimum energy efficiency criteria shown in Table 1. Manufacturers also have to agree to a set of award conditions before they are granted an award. Awards are year specific - the minimum energy efficiency criteria and the conditions will be updated each year.

Table 1. TESAW Eligibility Criteria

Product Category	Criterion
Clothes Dryers	≥3 stars
Clothes Washers	≥4.5 stars
Dishwashers	≥3.5 stars

3.3 Examples of How Energy Ratings Are Calculated

As mentioned before, energy or star ratings have been developed to provide consumers with an easy way of comparing the energy efficiency of different models. In this context, energy efficiency is defined as the "energy service per unit of energy consumption". It is a simple and fair way of comparing the energy consumption of products that do a similar job.

In the case of an air conditioner, for example, a model's efficiency is the amount of cooling capacity per unit of energy it consumes. A similar way of measuring the "energy efficiency" has been developed for all labelled appliances. Looking at the energy alone is not all that helpful, as a big appliance will nearly always use more energy than a small one, because it is doing more work. A measure of energy efficiency means that one can directly compare a great range of products.

The star rating system, for example, has a minimum of 1 star and a maximum of 6, shown in half star increments. Various "algorithms" or equations have been developed to rate the least efficient products at around 1 star. If appliance energy efficiency in the market never changed, the stars could be adjusted so that the best products on the market now rated 6 stars. However, manufacturers continuously work hard to improve their products and over time, star ratings gradually improve. Hence, under the current system, the most efficient products are generally only 3 or 4 stars (although there are some products that rate nearly 5 stars already for some appliance types), which leaves room for future improvement.

3.3.1 Energy Ratings for Clothes Washers

The energy consumption of a clothes washer is measured under conditions specified in an Australian Standard. Over a year, it is assumed that the clothes washer is used 7 times per week at rated capacity on a warm wash (warm CEC in red on the logo). A value for a cold wash energy of 7 times per week is also shown on the label (cold CEC in blue on the logo). Clothes washers are usually labeled on the "normal" or "regular" program (program specified for a normally soiled cotton load). The energy consumption of a clothes washer includes either electrical energy for motors and pumps and the energy embodied in any imported hot water or electrical energy used to heat the water internally. The majority of energy for a clothes washer is to heat water on a warm wash.

- **Capacity**

The measure of energy service for a clothes washer is rated load capacity. This is the value declared by the manufacturer and defines the test load.

- **Performance**

To be eligible for an energy label, a clothes washer must be able to meet a minimum level of wash performance, a minimum level of spinning performance and a must not exceed the "wear and tear" limits.

- **Base Energy Consumption (BEC) and Star Rating**

The Base Energy Consumption defines the "1 star" line for particular products. An additional star is awarded when the CEC of the model is reduced by a defined percentage from the BEC. The energy reduction per star is 27% for clothes washers. For example, a model that had a CEC that was 0.73 of the BEC or less would achieve 2 stars. Similar, a CEC of 0.533 (0.73 x 0.73) of the BEC or less would achieve 3 stars and so on.

For clothes washers, front and top loading models are rated on the same basis. The warm wash energy consumption and a component of residual moisture (spin performance) are used to define the star rating in comparison with the BEC. Therefore a model that has a good spin performance may get a marginally higher star rating than a model of the same capacity and CEC with a poor spin performance.

3.3.2 Energy Ratings for Dishwashers

The energy consumption of a dishwasher is measured under conditions specified in an Australian Standard. Over a year, it is assumed that the dishwasher is used 7 times per week (365 times per year). The program used for the energy labeling program is currently the one specified by the manufacturer, although by April 2004, all dishwashers will have to be re-labeled on their "normal" program using the revised AS/NZS 2007 Part 1 test method released in 2003.

- **Capacity**

The measure of energy service for a dishwasher is the number of place settings. This is the value declared by the manufacturer and defines the test load used in the Australian Standard.

- **Performance**

To be eligible for an energy label, a dishwasher must be able meet the specified wash and dry performance criteria defined in the Australian Standard.

- **Base Energy Consumption (BEC) and Star Rating**

The Base Energy Consumption defines the "1 star" line for particular products. An additional star is awarded when the CEC of the model is reduced by a defined percentage from the BEC. The energy reduction per star is 30% for dishwashers. For example, a model that had a CEC that was 0.70 of the BEC or less would achieve 2 stars. Similar, a CEC of 0.49 (0.70 x 0.70) of the BEC or less would achieve 3 stars and so on.

4.0 METHODOLOGY

As mentioned before, the purpose of this study was conduct a survey of electric appliances in Jordanian market with the purpose of identifying the most efficient

appliances in terms of water and energy consumptions. The appliances included in this survey were:

- Clothes Washers (Automatic and Semi Automatic),
- Dishwashers,
- Electric water heaters, and
- Toilets

Although toilets are not an electric appliance, they were included in this study to develop an understanding on the range of products available on the local market in terms of water consumption rates.

4.1 Sources of Data

Considering the nature of the study, it was first necessary to determine the types and brands of each appliance available on Jordanian markets. To do so, the IdRC team approached the Ministry of Industry and Trade (MoIT) in an attempt to obtain a list of electric appliances' importers and manufacturers that specifically import/manufacture one or more of the appliances under study. Unfortunately, the MoIT, was not able to furnish a list of registered Jordanian businesses that are authorized dealers of those specific electric appliances. The MoIT was only able to furnish general lists of companies that deal with electric appliances. This included a combined list of importers, distributors, dealers, etc., of all electric appliances with no clear distinction for each business' category and the type of appliances covered by the business. As a second potential source of data, the IdRC team addressed the Amman Chamber of Commerce, however, they were not able to furnish data that were more helpful than the MoIT's. The third entity addressed by the IdRC team was the Daman Program (Bureau Veritas). Despite numerous attempts, the person in charge never returned the IdRC's calls.

Finally, the IdRC team addressed the General Department of Statistics (DoS) and the Customs Department. The DoS's database was able to produce detailed lists of the types and quantities of the various electric appliances that had been imported into and/or manufactured in Jordan. The problem, however, was that the DoS's list included some electric appliances other than the four included in this study, and some of the quantities of imported appliances were in terms of weight rather than numbers. In addition, the DoS was not able to furnish any information regarding the companies that imported/manufactured the said appliances. Being the closest data to what was desired, the IdRC team reviewed those lists and identified the appliances that were covered in the scope of this study, and , and their corresponding total imported/manufactured quantities for the years 2002 and 2003. The Customs Department furnished lists similar to those furnished by the DoS, including the name of the Company/Business with import transactions for the years 2002 and 2003. Unfortunately, the Customs Department declined to furnish the quantities imported by each individual importer, but provided the total quantities imported into Jordan, which were also sometimes given as weights rather as numbers.

To obtain data on manufacturers of appliances, the IdRC team contacted the Unit for the Communication with Industries at the University of Jordan's faculty of engineering. The Unit was established to increase cooperation between Jordanian industries and faculty members at the University, and is, therefore, well connected with the industrial community in Jordan. The Unit was able to furnish the IdRC team

with the names of local industries that manufacture the appliances under study. A list of the local manufacturers is included in the Appendix.

4.1.1 Importer and Manufacturers Data

As mentioned before, the data obtained from the Customs Department included the names of the various importers for each type of appliance under consideration. Table 2 summarizes the numbers of different importers that import each of the appliances under study, and a detailed list of those importers is included in the Appendix.

Table 2. Jordanian Importers Numbers

Appliance	Number of Importers
Washers	49
Dishwashers	13
Water Heaters	55
Toilets	75

It should be mentioned that those numbers overlap since some importers import more than one type of appliance.

4.1.2 Descriptive Appliances Data

Table 3 summarizes the types of appliances that were identified by the DoS and the Customs Department's lists, and the corresponding import units in which they were reported, while Table 4 shows the total imported quantities for the various identified types of appliances. Tables 5 through 10 show the quantities of the various imported appliances' according to the country of origin for the years 2002 and 2003, and the quantities of the locally manufactured appliances for the same period. The same data presented in the tables are graphically depicted in Figures 5, 6, and 7.

As can be seen in the Tables and Figures, toilets washing machines are the mostly imported appliance with a total of quantity of nearly 140,000 toilets in the year 2003, followed by 59,000 washers and household dishwashers with quantities of nearly 59,000 and 468, respectively. The quantities of non-household dishwashers (i.e., for commercial uses such as hotels and restaurants) were only reported in terms of weight and were 2,700 Kg. The same applied to water heaters, which were also divided into two types; industrial use (3700 Kg), and non industrial use (258,500 Kg).

Regarding locally manufactured appliances, Washers were the mostly manufactured appliance (combining automatic and semi-automatic) with a total number of 110,000 washer, followed by toilets and water heaters with quantities of 60,000 and 50,000, respectively. It should be mentioned that part of the manufactured appliances are exported to foreign markets.

Table 3. Customs Department's Codes for Appliances Under Study

HS.Code	Commodity	Quantity Units
845011000	Household or laundry-type washing machines, each of a dry linen capacity not exceeding (10) kg fully- automatic machines.	No.
845012000	Household or laundry-type washing machines, each of a dry linen capacity not exceeding (10) kg, with built-in centrifugal	No.

	drier.	
845019000	Other household washing machines, each of a dry linen capacity not exceeding (10) kg, other than fully automatic or with built-in centrifugal drier machines.	No.
845020000	Household or laundry-type washing machines, each of a dry linen capacity exceeding 10 kg.	No.
851610100	Electric instantaneous or storage water heaters and immersion heaters, for industrial use.	Weight
851610900	Electric instantaneous or storage water heaters and immersion heaters, other than those for industrial use.	Weight
842211000	Dish washing machines, of the household type.	No.
842219000	Dish washing machines, other than the household type.	Weight
392220000	Lavatory seats and covers, of plastics	No.

Table 4. Imported Quantities of Appliances Under Study for the Years 2002 and 2003

Hs.Code Number	2002				2003			
	No.	Wt. (Kg)	% By No.	% By Wt.	No.	Wt. (Kg)	% By No.	% By Wt.
845011000	3805	-	8.05	-	620	-	1.06	-
845012000	9644	-	20.40	-	10444	-	17.79	-
845019000	33658	-	71.18	-	47156	-	80.34	-
845020000	179	-	0.38	-	477	-	0.81	-
851610100	-	30109	-	18.28	-	3698.70	-	1.41
851610900	-	134607	-	81.72	-	258454.18	-	98.59
842211000	754	-	100	-	468	-	100	-
842219000	-	6943	-	100	-	2751	-	100

Table 5: Imported Quantity Of Washing Machines by Country of Origin In 2002 & 2003

Country	Imported Quantity (No.) Of Washing Machines		Imported Quantity (%) Of Washing Machines	
	2002	2003	2002	2003
Taiwan	55	127	0.116	0.216
Japan	19	50	0.040	0.085
Denmark	3	20	0.006	0.034
U.K.	253	524	0.535	0.893
Spain	1045	699	2.210	1.191
U.S.A.	879	881	1.859	1.501
Germany	1783	312	3.771	0.532
Italy	7362	7343	15.569	12.510
Poland	2	0	0.004	0.000
Malaysia	143	113	0.302	0.193
Philippines	1810	2693	3.828	4.588
Free Zone	2397	485	5.069	0.826
South Korea	820	942	1.734	1.605
Thailand	4850	8832	10.257	15.047
Syria	390	101	0.825	0.172
Turkey	1547	930	3.272	1.584
India	1152	0	2.436	0.000
China	22776	34296	48.166	58.429
Sweden	0	1	0.000	0.002
Brazil	0	10	0.000	0.017
Indonesia	0	221	0.000	0.377
Egypt	0	100	0.000	0.170
Hong Kong	0	2	0.000	0.003
Belgium	0	15	0.000	0.026
Total	**47286**	**58697**	**100%**	**100%**

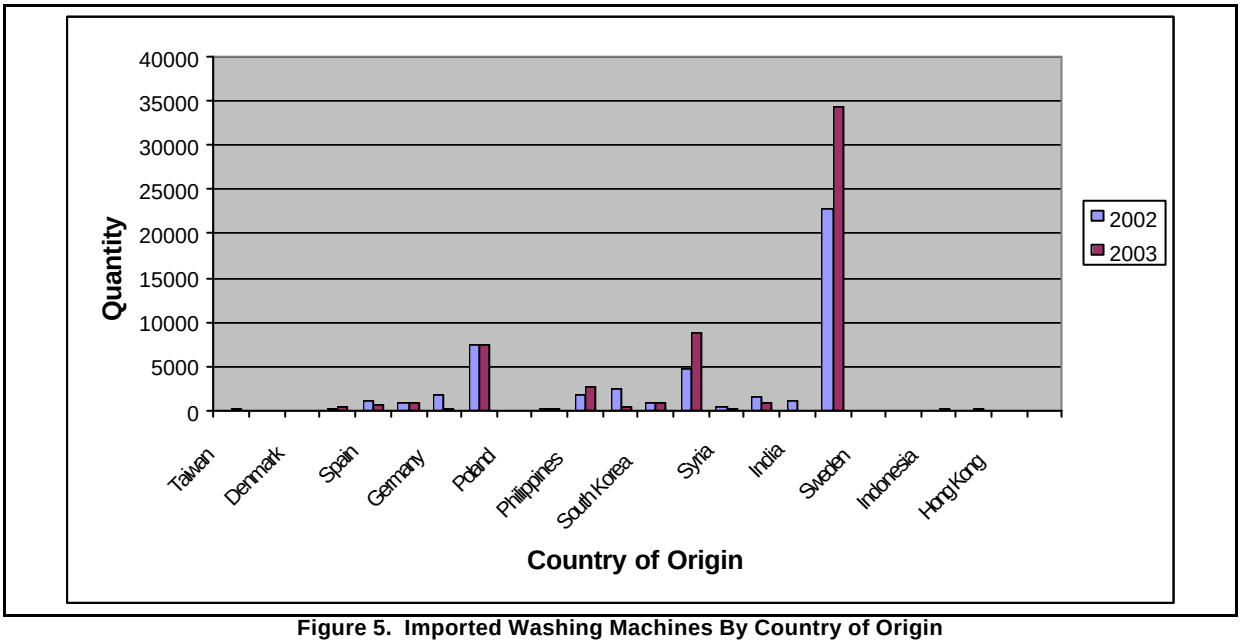


Figure 5. Imported Washing Machines By Country of Origin

Table 6: Imported Quantity Of Dish Washing Machines From Different Countries In 2002 & 2003

Household Type				
Country	**Imported Quantity (No.)**		**Imported Quantity (%)**	
	2002	**2003**	**2002**	**2003**
Japan	0	1	0	0.21
Spain	0	3	0	0.64
Taiwan	0	3	0	0.64
U.K.	0	34	0	7.26
U.S.A.	5	22	0.66	4.70
China	54	44	7.16	9.40
Germany	277	162	36.74	34.62
Italy	418	199	55.44	42.52
Total	**754**	**468**	**100%**	**100%**
Other Than The Household Type				
Country	**Imported Quantity (Kg)**		**Imported Quantity (%)**	
	2002	**2003**	**2002**	**2003**
U.K.	20	0	0.29	0
France	1000	0	14.40	0
Italy	1534	770	22.09	27.99
Germany	1922	1981	27.68	72.01
U.S.A.	2467	0	35.53	0
Total	**6943**	**2751**	**100%**	**100%**

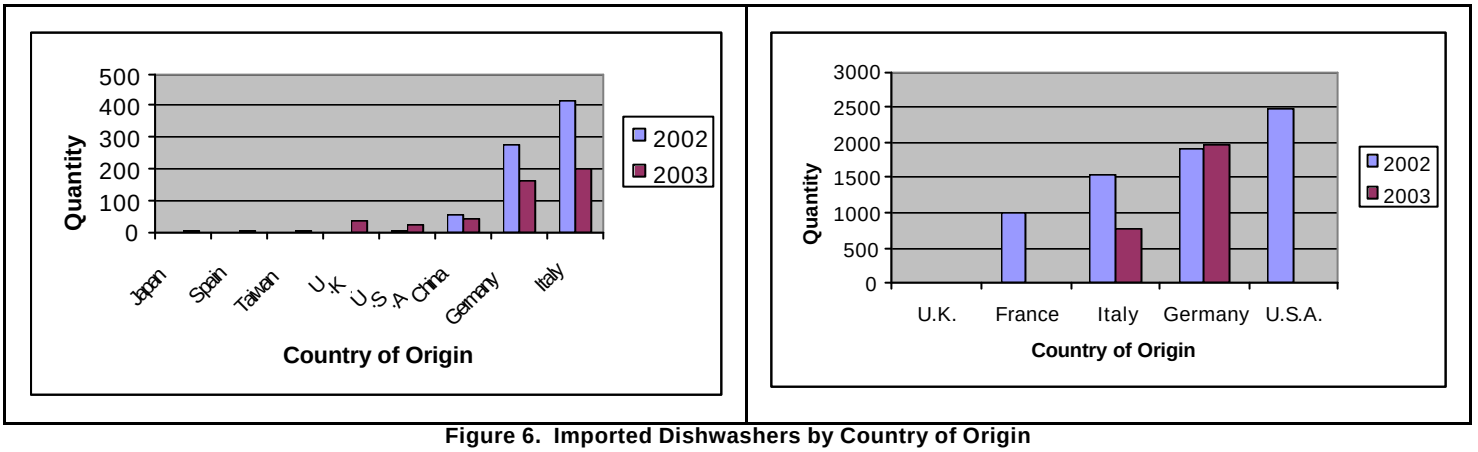


Figure 6. Imported Dishwashers by Country of Origin

Table 7: Imported Quantity Of Water Heater Machines by Country of Origin In 2002 & 2003

For Industrial use

Country	Imported Quantity (kg)		Imported Quantity (%)	
	2002	2003	2002	2003
Egypt	28600	10	95	0.3
Germany	0	13	0.000	0.4
China	0	272	0.000	7.3
U.K.	0	295	0.000	8
Italy	641	628	2.1	17
U.S.A.	718	2481	2.4	67
Hungary	150	0	0.5	0
Total	**30109**	**3699**	**100%**	**100%**

For Other Than Those For Industrial USE

Country	Imported Quantity (kg)		Imported Quantity (%)	
	2002	2003	2002	2003
France	0.000	54	0.000	0.0002
India	0.000	70	0.000	0.0003
Lebanon	0.000	150	0.000	0.0006
Thailand	0.000	1030	0.000	0.0040
Sweden	0.000	306	0.000	0.0012
Netherland	1200	540	0.0089	0.0021
South Africa	0.000	194	0.000	0.0008
Saudi Arabia	0.000	1700	0.000	0.0066
Hong Kong	0.000	38	0.000	0.0001
Syria	0.000	2065	0.000	0.0080
Israel	0.000	1140	0.000	0.0044
Turkey	0.000	3273	0.000	0.0127
U.k.	1990	1003	0.0148	0.0039
U.s.a.	8096	1511	0.0601	0.0058
U.a. Emirates	5000	13398	0.0371	0.0518
Germany	1111	4938	0.0083	0.0191
China	17169	34281	0.1275	0.1326
Italy	28318	50203	0.2104	0.1942
South Korea	7930	43075	0.0589	0.1667
Egypt	59878	99485	0.4448	0.3849
Switzerland	23	0.000	0.0002	0.000
Turkey	146	0.000	0.0011	0.000
Spain	870	0.000	0.0065	0.000
Taiwan	2876	0.000	0.0214	0.000
Total	**134607**	**258454**	**100%**	**100%**

Table 8: Imported Quantity Of 'Lavatory Seats And Covers, Of Plastics (Hs Code - 392220000) by Country of Origin In 2002 & 2003

Country	Imported Quantity		Imported Quantity (%)	
	2002	2003	2002	2003
Taiwan	0	400	0	0.28
Denmark	0	120	0	0.09
Netherlands	0	324	0	0.23
U.S.A.	0	629	0	0.45
Syria	0	3744	0	2.65
Germany	608	2463	1.00	1.75
Turkey	3130	12166	5.16	8.62
Egypt	0	14487	0	10.27
Spain	3173	7004	5.23	4.96
Iran	0	13150	0	9.32
Italy	16490	18300	27.18	12.97
China	25817	22015	42.55	15.60
U.A. Emirates	11450	46310	18.87	32.82
Total	**60668**	**141112**	**100%**	**100%**

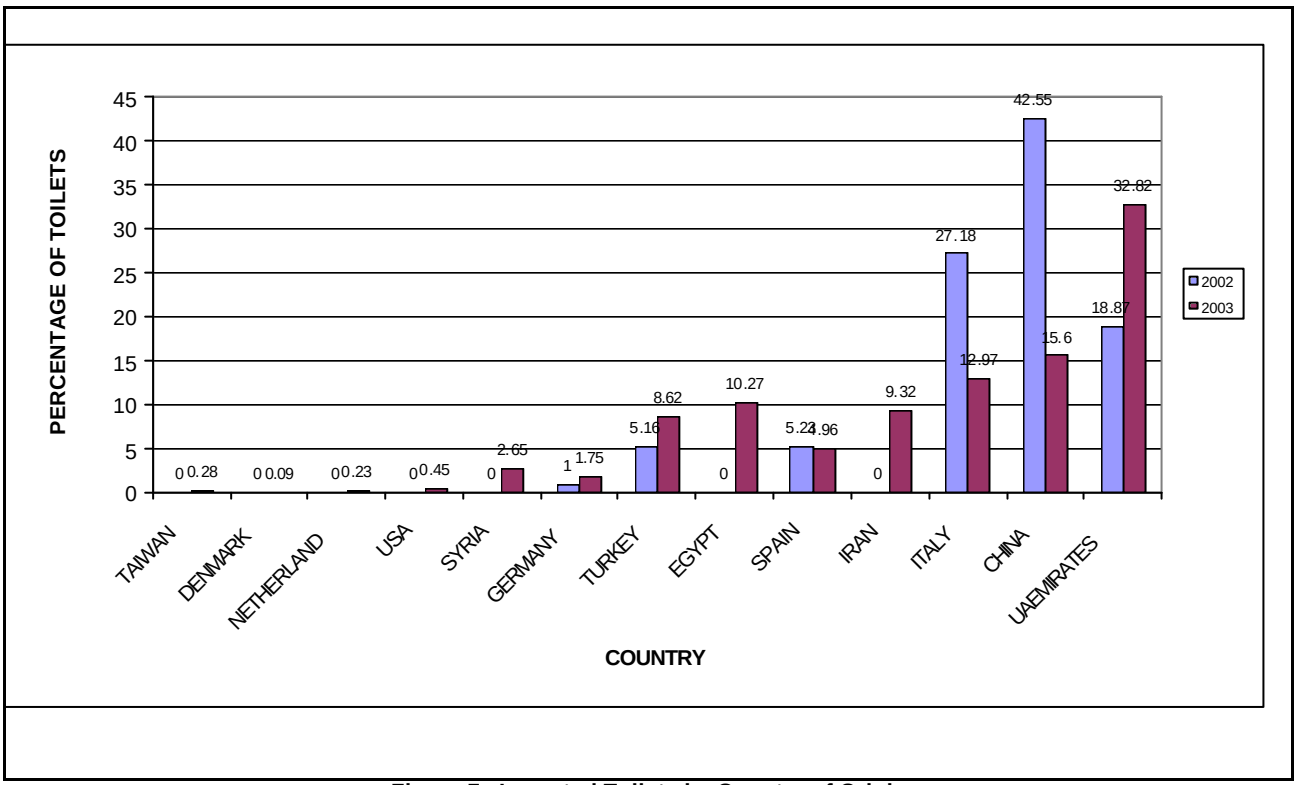


Figure 7. Imported Toilets by Country of Origin

Table 9: Annual Locally Manufactured Appliances Quantities For The Year 2003

Type	No.
Twin-Tub W.M.	60000
Single-Tub W.M.	40000
Full Automatic	10000
Electrical Water Heater	50000
Ceramics (Toilet, Bidet, Sink)	50000-60000

Table 10: Locally Manufactured Dishwashing Machines

Type	Model	Standards			Power (Watt/cycle)
		Power (Watt/h)	Water Capacity (L)	Cycle Time (min)	
LG	LD-2050WH	NA	NA	NA	NA
LG	LD-2050SH	NA	NA	NA	NA
LG	LD-2050MH	NA	NA	NA	NA

4.1.3 Technical Specification Data

Using the importers' and manufacturers' names obtained from the Customs Department and the University of Jordan, respectively, the *b*dRC study team built a database of importers' names and contact information (address and telephone number). Afterwards, the *l*dRC study team designed a survey questionnaire (see Appendix) intended to capture the appliance related data needed to meet the objectives of the study.

Following that the *l*dRC study team started contacting the various entities and arranging site visits. During the visit, the *b*dRC study team gave an overview of the study, its objectives, and what the collected data would be used for. After such introduction, an *l*dRC engineer went over the questionnaire with the company's representative to gather the required data. The collected technical specifications and the purpose of those data are summarized in Table 11.

Generally, the *b*dRC team asked the importer to provide them with catalogues for the various brands to facilitate the extraction of those data. Unfortunately, not all importers were willing to provide the catalogues, which led the *b*dRC study team to extract the data from specifications tags on the machines themselves. Some machines did not have a specification tag and the importer could not provide the required data. Although very few, for those brands, the *b*dRC study team visited the mother companies' websites and in some instances send correspondences to those companies. Despite numerous attempts, not all the companies responded, which led to some minor gaps in technical specifications for some brands.

Table 11. Collected Data and Purpose

Data Item	Appliance	Purpose
Type/Model	All	To be able to conduct analysis for brands that have several models
Load Capacity	Washers and Dishwashers	To help establish a relation between capacity (Kg) and water consumption
Water Consumption For One Cycle.	Washers and Dishwashers	To determine the water consumption
Energy Consumption For One Cycle.	Washers and Dishwashers	To determine the energy consumption
Cycle Time	Washers and Dishwashers	To relate water/energy consumption for various cycle lengths
Water Capacity	Water Heaters and Toilets	To determine the water consumption
Country Of Origin	All	For comparing the various efficiencies cross country

5.0 DATA ANALYSIS

All the water/energy consumption related data were categorized as per type; model; washing capacity; cycle time; water consumption per cycle; electric power consumption per cycle and the cost of water and electric power consumption. Certain assumptions had to be made to complete the analysis. For example, one assumption that is used by labeling programs around the world, as well as the one at hand, is that a certain appliance is used for a constant period of time (e.g., once a week, once a day, etc.). Also, considering that different brands have different washing cycles, a common cycle –the white wash-cycle is assumed for all uses, and so on. The assumptions made for the study at hand are listed in Table 12 with the purpose of the assumption.

Table 12. Assumptions for Analyses and Purpose

Assumption	Appliance	Purpose
365 uses per year	Washers, Dishwashers, Heaters	To normalize the annual consumption for all brands over the course of one year
Longest Cycle length	Washers and Dishwashers	To normalize the annual consumption against a common basis (e.g., white wash)
Most washers supplemented by water heater, except U.S. models	Washers	This is particularly for U.S. washers in order to estimate the total energy consumption and compare it to models with heaters
Average size of household is 6 people	Toilets	To estimate annual water consumption
2 uses per day per person	Toilets	To estimate annual water consumption
Billing Cycle of 90 days	Toilets	To estimate annual water consumption
Operating Life of 10 years	Washers, Dishwashers, Heaters	For cash flow analyses purposes
Operating Life of 20 years	Toilets	For cash flow analyses purposes

5.1 Operating Cost Calculations

5.1.1 Automatic and Semi Automatic Washers' Calculations

To estimate the water/energy consumption for washers, thus, their operating costs, the following equations were used:

$$\text{Power Consumption} = \frac{\left\{\left[\text{Washing Power} \times \frac{\text{Washing Cycle}}{60}\right] + \left[\text{Dryer Power} \times \frac{\text{Dryer Cycle}}{60}\right]\right\}}{\text{Washing Capacity}} \quad (1)$$

Where,

Power Consumption = Washer's power consumption (Watt per Kg of load)

Washing Power = Washer's power ability (Watt per hour of use)

Washing Cycle = Length of wash cycle (minutes)

Dryer Power = Washer's drying power (Watt per hour of use)

Drying Cycle = Length of drying cycle (minutes)

Washing Capacity = Capacity of washer in Kg of clothing

And,

$$\text{Water Consumption} = \frac{\text{Water Consumption}}{\text{Washing Capacity}} \quad (2)$$

Where,

Water Consumption = Washer's water consumption (L/Kg of load)

Water Consumption = Total water consumption for a complete full-load wash

Washing Capacity = Capacity of washer in Kg of clothing

All data used in the application of the two equations are those obtained from the field visits to the various importers, surveys completed during the visits, and catalogues furnished by some of the importers. It should be mentioned that, in general, a washer's capacity is the weight of damp clothing that it can accommodate.

With the power and water consumption estimated per unit weight of load, it was fairly easy to compute the cost of energy and water per unit weight of load. This was done by multiplying the consumptions per unit weight by the local tariff for water and electricity using the following equations:

$$\text{Power Cost} = \frac{\text{Total Power Consumption}}{1000(\text{W/kW})} \times \text{unitcost} \quad (3)$$

$$\text{Water Cost} = \text{Water Consumption} \times \text{unitcost} \quad (4)$$

$$\text{Total Cost} = \text{Water Cost} + \text{Power Cost}) \quad (5)$$

Where,

Power Cost = cost of power consumed in one complete wash (fils/Kg)

Water Cost = cost of water consumed in one complete wash (fils/Kg)

Unit cost = unit cost of water and electricity according to tariff (fils/unit) shown in Table 13

Once the total cost is estimated using the equation above, one could easily compute the total annual water/energy consumption for washers on the basis of the 365 days of use mentioned earlier.

Table 13. Water and Electricity Tariff

Type	Quantity	Units	Unit Cost (JD)
Water	0-20	m^3	0.148
	21-40	m^3	0.167
Power	1-160	Kilo Watts	0.031
	161-300	Kilo Watts	0.055

Note: The Twin-Tub washers need extra water for rinsing process.

5.1.2 Dish-Washers Calculations

To estimate the water/energy consumption for washers, thus, their operating costs, the following equations were used:

$$\text{Total Power Consumption} = \text{Power Rate} \times \frac{\text{Cycle time}}{60(\text{min/h})} \quad (6)$$

Where,

Power Consumption = Dishwasher's power consumption (Watt per Cycle)

Power Rate = Dishwasher's power ability (Watt per hour of use)

Cycle = Length of cycle (minutes)

Then,

$$\text{Power Cost} = \frac{\text{Total Power Consumption}}{1000(\text{W/kW})} \times \text{Unit Cost} \quad (7)$$

and,

$$\text{Water Cost} = \text{Water Consumption}(\text{m3/cycle}) \times \text{Unit Cost} \quad (8)$$

$$\text{Total Cost} = \text{Water Cost} + \text{Power Cost} \quad (9)$$

$$\text{Total Cost per set} = \frac{\text{Total Cost}}{\text{Number of sets/cycle}} \quad (10)$$

5.1.3 Water Heaters Calculations

To estimate the water/energy consumption for water heaters and their operating costs, the following equations were used:

$$\text{Total Power Consumption} = \frac{\text{Power Consumption} \times \text{Cycle time}}{60(\text{min/h}) \times \text{Water Capacity} \times \text{Temperature}} \quad (11)$$

Where,

Power Consumption	= Heater's power consumption (Watt per L-^{o}c cycle)
Heater Power	= Heater's power (Watt per hour of use)
Cycle	= Length of heating cycle (minutes)
Capacity	= Water capacity of heater in Liters

Thus, the monthly cost of operating a water heater would be calculated as follows

$$\text{Power Consumption(kW/month)} = \frac{\text{Power Consumption(W/h)}}{1000(\text{W/kW})} \times \frac{\text{Cycle Time(min/day)} \times 30(\text{day/month})}{60(\text{min/h})} \quad (12)$$

and using the tariff for electricity, cost of operation would e calculated as follows the

$$\text{Power Cost(fils/LC}^{o}) = \frac{\text{Power Consumption(W/LC}^{o})}{1000(\text{W/kW})} \times \text{Cost(fils/kW)} \quad (13)$$

$$\text{Power Cost(fils/C}^{o}) = \text{Power Cost(fils/LC}^{o}) \times \text{Water Capacity(L)} \quad (14)$$

$$\text{Power Cost(fils/L)} = \frac{\text{Power Cost(fils/C}^{o}) \times \text{Temperature(C}^{o})}{\text{Water Capacity(L)}} \quad (15)$$

5.1.4 Sanitary Calculations

Water consumption calculations of toilets were straight forward and were based on the toilet tank capacity, the size of the household, and the average number of daily use per person. This is shown in the following equations

$$\text{Water Consumption} = (\text{Avg. household}) \times (\text{Tiolet usage/person. day}) \times (\text{Tiolet tank capacity} \times (\text{Length of Billing Cycle})$$

$$\text{Water Cost} = \text{Water Consumption} \times \text{Unit Cost}$$

6.0 RESULTS

This section presents the results of the operating cost analyses conducted for the various appliances covered in this survey. The results are presented for each appliance, with the imported and locally manufactured brands presented separately.

6.1 Washers

As presented in earlier sections, two types of washers were addressed in this survey. Those were full automatic washers and semi-automatic (twin-tub washers). Furthermore, the washers of both kinds were categorized into imported washers and locally manufactured washers. The following sections summarize the water/energy consumption costs for each of the four categories (i.e., automatic and semi-automatic that are imported and manufactured locally).

6.1.1 Imported Washers

6.1.1.1 Automatic

Table 14 presents the water and energy consumption costs for imported automatic washers per Kg of load. The data are for 30 different brands and models that were surveyed. As mentioned before, there were brands/models for which the data could not be obtained, either because the importer could not furnish that data, or because the mother company did not respond to the *t*RC's correspondences. Again, the cost was estimated using the one common washing program for all brands (i.e., the white wash cycle), and per Kg of load, to ensure that the compared costs were normalized across the range of brands despite differences in load capacities.

As can be seen in the Table, the unit cost for operating an imported automatic washer (i.e., fils per Kg of load) varies from 10 fils to over 30 fils, indicating that there is a wide range of efficiency among the different brands. The effect of such variance can be better envisioned when projected over the life time of the machine and compared against the prices of the different washers as will be seen in a following section.

Table 14. Operational Costs for Imported Automatic Washers

Brand/Model	Water Capacity (L)	Washing Capacity (kg)	Water Consumption L/Kg	Power Consumption W-hr/Kg	Water Cost fils/kg	Power Cost fils/kg	Total Cost fils/kg
Ignis	20	5	4.00	660.0	0.60	20.5	21.1
Samsong-P1293	54	5.5	9.82	339.7	1.47	10.5	12.0
Samsong-P1093	54	5.5	9.82	339.7	1.47	10.5	12.0
Haier-HG-800E	59	5	11.80	525.0	1.77	16.3	18.0
Bosch WFO2430AU	45	6	7.50	343.1	1.13	10.6	11.8
Bosch WFD2061ME	65	5	13.00	393.3	1.95	12.2	14.1

AEG 1059	54	5.5	9.82	341.8	1.47	10.6	12.1
AEG 88730	39	5.5	7.09	323.6	1.06	10.0	11.1
AEG 1259	49	5.5	8.91	341.8	1.34	10.6	11.9
AEG 1459	44	5.5	8.00	341.8	1.20	10.6	11.8
AEG LL1800	34	5.5	6.18	305.5	0.93	9.5	10.4
AEG LL1600	38	5.5	6.91	305.5	1.04	9.5	10.5
AEG 86741	39	5.5	7.09	330.9	1.06	10.3	11.3
AEG 76730	42	5.5	7.64	341.8	1.15	10.6	11.7
AEG 16810	58	6	9.67	366.7	1.45	11.4	12.8
Electa L600TX-F	49	5	9.80	975.0	1.47	30.2	31.7
Maister	49	5	9.80	975.0	1.47	30.2	31.7
Hanseatic	49	5	9.80	920.0	2.16	19.5	21.7
Arsiton-500	72	5	14.40	630.0	1.62	19.5	21.2
Arsiton-600	54	5	10.80	630.0	1.62	19.5	21.2
Arsiton-900	54	5	10.80	630.0	1.34	17.8	19.1
Arsiton-800	49	5.5	8.91	572.7	0.60	20.5	21.1
Arsiton	54	7	7.71	450.0	1.16	14.0	15.1
General Electric WWH6402	55	5	11.00	916.7	1.65	28.4	30.1
General Electric WWH7709	55	6	9.17	977.8	1.38	30.3	31.7
Haier	59	5	11.80	758.3	1.77	23.5	25.3
DAEWOO-without heater*	54	5	10.80	56.0	1.62	28.7	30.4
Thomson-1000rpm-F-650	53	5	10.60	990.0	1.59	30.7	32.3
Indesit W431TX	71	5	14.20	444.5	2.13	13.8	15.9
Indesit W84TX	52	5	10.40	300.0	1.56	9.3	10.9

* without heater , adding 2.5fils/L for 55C^{o}

6.1.1.2 Semi-Automatic (Twin Tub)

Table 15 presents the water and energy consumption costs for imported semi-automatic washers per Kg of load. Although 29 different brands were identified, the data were available for only 18 brands. Again, the cost was estimated using the one common washing program for all brands (i.e., the white wash cycle), and per Kg of load, to ensure that the compared costs were normalized across the range of brands despite differences in load capacities. It should be mentioned that due to the semi automatic nature of machine, parts of the water consumption arte controlled by the user. The rinsing process is controlled by the user, thus, the amount of water consumed varies among users. It was impossible to estimate this portion of the water consumption. The analyses, therefore, were confined to the portions of the water consumption that were machine controlled. It is believed that the human factor in the water consumption aspects of this types of washers can be improved via educational and awareness campaigns.

As can be seen in the Table, the unit cost for operating an imported semi-automatic washer (i.e., fils per Kg of load) is significantly lower than that for an automatic washer. Again this is due to the fact that the majority of the cost is user controlled (during the rinsing process). Differences in the operational cost among semi-automatic washers are also better envisioned when projected over the life time of the machine and compared against the prices of the different washers as will be seen in a following section.

Table 15. Operational Costs for Imported Semi-Automatic Washers

Brand/Model	Water Capacity (L)	Washing Capacity (kg)	Water Consumption L/Kg	Power Consumption W/Kg	Water Cost fils/kg	Power Cost fils/kg	Total Cost fils/kg

General Pack	20	6	15.56	3.33	0.48	0.5	1.0
Aman	70	8.5	15.29	8.24	0.47	1.2	1.7
National Electric	84	11	10.30	7.64	0.32	1.1	1.5
White Westinghouse Mws939za*	85	10.1	40.84	8.42	1.27	1.3	2.5
Aftroon Afw7550	72	7	21.79	10.29	0.68	1.5	2.2
Aftroon Afw4650	49	4	29.38	12.25	0.91	1.8	2.7
Toshiba - Vh5500bt1	20	5.5	16.82	3.64	0.52	0.5	1.1
Royal -Dw 250	15	3.5	17.14	4.29	0.53	0.6	1.2
Aman- Xpb82-388s	70	8.5	15.29	8.24	0.47	1.2	1.7
Leonard-4.5kg	Na	4.5	19.44	0.00	0.60	0.0	0.6
Leonard-2.5kg	Na	2.5	28.00	0.00	0.87	0.0	0.9
Sharp-5.5kg	30	5.5	20.23	5.45	0.63	0.8	1.4
Daewoo-7kg	43	7	12.32	6.14	0.38	0.9	1.3
Hetachi-Ps950ap	56	5	22.17	11.20	0.69	1.7	2.4
Hetachi-Ps960ap	56	5	22.17	11.20	0.69	1.7	2.4
Hetachi-Ps970ap	56	5	22.17	11.20	0.69	1.7	2.4
Hetachi-Ps980ap	56	5	22.17	11.20	0.69	1.7	2.4
Hetachi-Ps990ap	72	11	9.89	6.55	0.31	1.0	1.3

* without dryer

6.1.2 Locally Manufactured Washers

The survey revealed that both automatic washers and semi-automatic washers are manufactured in Jordan. Those are mainly LG appliances, which are manufactured both for local market consumption and export purposes. The majority of the production, however, is for export to foreign regional markets.

6.1.2.1 Automatic

The water and energy consumption costs for the various LG full automatic models manufactured locally are presented in Table 16. As wit the imported models, those consumption costs are presented per Kg of load. Data were obtained for 28 manufactured models. The cost was estimated using the one common washing program for all brands (i.e., the white wash cycle), and per Kg of load, to ensure that the compared costs were normalized across the range of brands despite differences in load capacities.

As can be seen in the Table, the unit cost for operating a locally manufactured automatic washer (i.e., fils per Kg of load) varies from 24 fils to over 30 fils. Variation among the different models is less obvious than for imported models. This due to the fact that all the surveyed locally manufactured washers have the same load capacity. A more meaningful comparison can be made when those operational costs are projected over the life time of the machine and compared against the prices of the different models as will be seen in a following section.

Table 16. Operational Costs for Locally Manufactured Automatic Washers

LG Model	Water Capacity (L)	Washing Capacity (kg)	Water Consumption L/Kg	Power Consumption W/Kg	Water Cost fils/kg	Power Cost fils/kg	Total Cost fils/kg
WD-1050F	67	7	9.6	733.3	1.44	22.73	24.2
WD(M)-10160(5)F	67	7	9.6	853.8	1.44	26.47	27.9
WD(M)-80160F	67	7	9.6	853.8	1.44	26.47	27.9
WD(M)-65160F	67	7	9.6	853.8	1.44	26.47	27.9
WD-8050F	67	7	9.6	733.3	1.44	22.73	24.2
WD-1374(6)F(H)B	85	7	12.1	1030.8	1.82	31.95	33.8

WD-1274(6)F(H)B	85	7	12.1	1030.8	1.82	31.95	33.8
WD-1174(6)F(H)B	85	7	12.1	1030.8	1.82	31.95	33.8
WD-1074(6)F(H)B	85	7	12.1	1030.8	1.82	31.95	33.8
WD-8074F(H)B	85	7	12.1	1030.8	1.82	31.95	33.8
WD-8078FHB	85	7	12.1	1030.8	1.82	31.95	33.8
WD-1078FHB	85	7	12.1	1030.8	1.82	31.95	33.8
WD-65130F	67	7	9.6	827.6	1.44	25.66	27.1
WD-80130F	67	7	9.6	827.6	1.44	25.66	27.1
WD-10130(5)F	67	7	9.6	827.6	1.44	25.66	27.1
WD-13150(5)FB	75	7	10.7	795.0	1.61	24.65	26.3
WD-12150(5)FB	75	7	10.7	795.0	1.61	24.65	26.3
WD-11150(5)FB	75	7	10.7	795.0	1.61	24.65	26.3
WD-10150(5)FB	75	7	10.7	795.0	1.61	24.65	26.3
WD-80150(5)FB	75	7	10.7	795.0	1.61	24.65	26.3
WD-12160FB	75	7	10.7	795.0	1.61	24.65	26.3
WD-10120RD	75	7	10.7	926.5	1.61	28.72	30.3
WD-10125RD	75	7	10.7	926.5	1.61	28.72	30.3
WD-12120RD	75	7	10.7	926.5	1.61	28.72	30.3
WD-12125RD	75	7	10.7	926.5	1.61	28.72	30.3
WD-14120RD	75	7	10.7	926.5	1.61	28.72	30.3
WD-14125RD	75	7	10.7	926.5	1.61	28.72	30.3
WD-1485FD	75	7	10.7	926.5	1.61	28.72	30.3

* without heater , adding 2.5fils/L for 55C^{o}

6.1.2.2 Semi-Automatic (Twin Tub)

Table 17 presents the water and energy consumption costs for the Jordanian manufactured LG semi-automatic washers per Kg of load. Only seven different models were identified in the survey. Again, the cost was estimated using the one common washing program for all brands (i.e., the white wash cycle), and per Kg of load, to ensure that the compared costs were normalized across the range of brands despite differences in load capacities. As mentioned in a previous section the semi automatic nature of machine entails user controlled water consumption (rinsing process). Being impossible to estimate without actual end use surveys, the analyses were confined to the portions of the water consumption that were machine controlled.

As can be seen in the Table, the unit cost for operating an imported semi-automatic washer (i.e., fils per Kg of load) is significantly lower than that for an automatic washer, yet in line with those for the imported washers. Differences in the operational cost among semi-automatic washers can be better envisioned when projected over the life time of the machine and compared against the prices of the different washers as will be seen in a following section.

Table 17. Operational Costs for Locally Manufactured Semi-Automatic Washers

LG Model	Water Capacity (L)	Washing Capacity (kg)	Water Consumption L/Kg	Power Consumption W/Kg	Water Cost fils/kg	Power Cost fils/kg	Total Cost fils/kg
LG-WP-610NP	50	3	16.7	8.2	2.50	0.3	2.8
LG-WP-620NP	50	3	16.7	8.2	2.50	0.3	2.8
LG-WP-680NP	50	3	16.7	8.2	2.50	0.3	2.8
LG-WP-1300QP	88	7.5	11.7	4.7	1.76	0.1	1.9
LG-WP-1310QP	88	7.5	11.7	4.7	1.76	0.1	1.9
LG-WP-730NP	42	3	14.0	8.6	2.10	0.3	2.4

LG-WP-780NP	42	3	14.0	8.6	2.10	0.3	2.4

* without dryer

6.2 Dishwashers

Unlike U.S. and European consumers, the Jordanian consumers are not big users of automatic dishwashers. This is mostly due to their high costs compared to the average national income, and the higher rates of electricity, which deems them infeasible for domestic use. Dishwashers are highly used, however, by hotels and restaurants in Jordan, who are the main consumers of such appliance. The two main categories of dishwashers included in this study are imported dishwashers and locally manufactured dishwashers. Unfortunately, data for the locally manufactured dishwashers were not available. Although the study team officially requested the data through the Chairman of the Amman Chamber of Commerce, the data were not obtained. Table 18 presents the water and energy consumption costs for imported automatic dish washers per set. The data are for 10 different brands and models that were surveyed. As can be seen in the Table, the unit cost for operating an imported automatic washer (i.e., fils per set) varies from 5 fils to over 8 fils, indicating that there is a wide range of efficiency among the different brands. The effect of such variance can be better envisioned when projected over the life time of the machine and compared against the prices of the different models as will be seen in a following section.

Table 18. Operational Costs for Dish Washers

Brand and Model	Water Capacity (L/cycle)	Cycle Time (min)	No. of Sets /Cycle	Power (Watt/cycle)	Water Cost (fils/cycle)	Power Cost(fils/cycle)	Total Cost (fils/cycle)	Total Cost (fils/set)
Bosch CGS3312EU/12 sets	21	120	12	3200.0	3.15	99.20	102.35	8.53
Bosch CGS6952/12 sets	21	120	12	3200.0	3.15	99.20	102.35	8.53
AEG 6820/12 sets	17	90	12	1650.0	2.55	51.15	53.70	4.48
AEG 80800/12 sets	15	90	12	1650.0	2.25	51.15	53.40	4.45
AEG 40730/12 sets	15	90	12	1950.0	2.25	60.45	62.70	5.23
AEG 6081/12 sets	17	90	12	1650.0	2.55	51.15	53.70	4.48
SINSER SWQP12-AFM/12 sets	17	90	12	3150.0	2.55	97.65	100.20	8.35
CANDY CD602S/12 sets	22	65	12	2329.2	3.30	72.20	75.50	6.29
CANDY CD675SA/12 sets	22	65	12	2329.2	3.30	72.20	75.50	6.29
Indesit T62SI/12 set	18	60	12	2100	2.70	65.10	67.80	5.65

6.3 Water Heaters

Water heaters are a highly used appliance in Jordan, especially in lower income homes that have no central heating systems. They are also widely used in office buildings. Although widely imported and widely manufactured locally, the study team was only able to obtain data for some of the imported models. Table 19 presents the water and energy consumption costs for imported water heaters for 12 different brands and models that were surveyed. As can be seen in the Table, the unit cost for operating an imported automatic washer (i.e., fils per Liter) varies from 1.6 fils to over 3 fils, indicating that there is a wide range of efficiency among the different brands. The effect of such variance can be better envisioned when projected over the life time of the heater and compared against the prices of the different models as will be seen in a following section.

Table 19. Operational Costs for Water Heaters

Type	Standards		Temperature C^o	Power Consumption Watt/ L C^o cycle	Power Cost fils/L C^o	Power Cost fils/ C^o	Power Cost fils/L
	Power (Watt-h)	Water Capacity (L)					
Ariston-50L	1500	50	55	1.45	0.045	2.25	2.480
Ariston-80L	1500	80	55	0.97	0.030	2.40	1.647
Ariston-100L	2000	100	55	1.16	0.064	6.40	3.520
Sdec-50L	1500	50	55	1.45	0.045	2.25	2.480
Sdec-80L	1500	80	55	0.97	0.030	2.40	1.647
Sdec-100L	2000	100	55	1.16	0.064	6.40	3.520
AOPLLO 4-10L	1500	10	55	1.45	0.045	0.45	2.480
AOPLLO 4-20L	1500	20	55	1.45	0.045	0.90	2.480
AOPLLO 4-30L	1500	30	55	1.45	0.045	1.35	2.480
AOPLLO 4-50L	1500	50	55	1.45	0.045	2.25	2.480
AOPLLO 4-80L	1500	80	55	0.97	0.030	2.40	1.647
AOPLLO 4-100L	2000	100	55	1.16	0.064	6.40	3.520

6.4 Toilets

As mentioned before, a wide range of toilet tank models were cited in the market; both locally manufactured and imported. Table 20 presents the water and energy consumption costs for imported and locally manufactured toilet tanks for the different brands and models that were surveyed. The water consumptions were calculated

per a water billing cycle of three months using the toilet tank's storage capacity, and using the usage assumption stated earlier (i.e., average household size of 6 people with an average daily toilet use of 2 times per person). As can be seen in the Table, the unit cost for operating toilets (i.e., fils per Liter) varies from 1.6 fils to over 3 fils, indicating that there is a wide range of efficiency among the different brands and sizes. The effect of such variance can be better envisioned when projected over the life time of the toilet and compared against the prices of the different models as will be seen in a following section.

Table 20. Operational Costs for Toilets

Nationality	Toilet Tank Water Capacity (L)	Water Consumption (L/cycle)	Toilet Water Cost (fils/cycle)
Pakistan	15	16200	2430.0
Portugal	5	5400	810.0
	15	16200	2430.0
China	6	6480	972.0
	15	16200	2430.0
Jordan	2.3	2484	372.6
	5	5400	810.0
	9	9720	1458.0
	10	10800	1620.0
Italy	9	9720	1458.0
	10	10800	1620.0
Italy (dual flush)	3.5	3780	567.0
	4.5	4860	729.0
Saudi Arabia	10	10800	1620.0
India	10	10800	1620.0
France (dual flush)	3	3240	486.0
Egypt	5	5400	810.0
	10	10800	1620.0
Japan	6	6480	972.0
U.S.A	6	6480	972.0
Turkey	5	5400	810.0
Spain	5	5400	810.0
	6	6480	972.0
	10	10800	1620.0
Germany	6	6480	972.0
Germany (dual flush)	3.5	3780	567.0
Palestine (T)*	6	6480	972.0
Germany (T)*	7	7560	1134.0
	9	9720	1458.0
UK (T)*	7	7560	1134.0
	9	9720	1458.0

T: Turkish toilet

6.5 Water and Energy Ratings

The previous sections presented how the water/energy consumptions varied for the different models of the various appliances. Such variation reflects on the owners' cost of owning and operating such appliances. Furthermore, the normalization of the collected data allows for direct comparison between the different models. For instance, the loads of different washers vary widely, thus, resulting in washers of bigger loads to consume more energy and water. For this reason the consumptions for washers were always computed per unit load. This allowed for direct comparison between washers of different load capacities.

In an attempt to categorize the various surveyed appliances in a **manner** similar to what international energy labeling programs do, the study team divided each types of surveyed appliance into three categories:

1. Efficient Models
2. Medium Efficient Models, and
3. Not Efficient Models.

The categorization was based on the total operating cost of the appliance (i.e., cost of electricity and water). Those categories can be thought of as the equivalent of star ratings in the Star Energy Program in the U.S., or the letter equivalents in Europe. The following sections present the findings for different appliances' models.

6.5.1 Twin Tub Washing Machines

Twin Tub washing machines are classified into the following three grades:

1. For total operating cost of up to 1.3 fils/kg, the grade was considered ***Efficient*.**

2. For total operating cost between 1.4 and 2.3 fils/kg, the grade was considered ***Medium Efficient*.**

3. For total operating cost greater than 2.4 fils/kg, the grade was considered ***Not Efficient*.**

Using those classifications and using the operating costs determined in a previous section, the surveyed semi-automatic washers are classified as shown in Table 21. As can be seen in the Table, 44% of the surveyed models are Not Efficient.

Table 21. Ratings for Surveyed Semi-Automatic Washers

Efficient	Medium Efficient	Not Efficient
Leonard-4.5kg	Sharp-5.5kg	Hetachi-Ps950ap
Leonard-2.5kg	National Electric	Hetachi-Ps960ap
General Pack	Aman	Hetachi-Ps970ap
Toshiba - Vh5500bt1	Aman- Xpb82-388s	Hetachi-Ps980ap
Royal -Dw 250	LG-WP-1300QP	LG-WP-730NP
Daewoo-7kg	LG-WP-1310QP	LG-WP-780NP
Hetachi-Ps990ap	Aftroon Afw7550	White Westinghouse
		Aftroon Afw4650
		LG-WP-610NP
		LG-WP-620NP
		LG-WP-680NP
7 models (28%)	**7 models (28%)**	**11 models 44%**

6.5.2 Automatic Washing Machines

Automatic washing machines were also classified into three grades as follows:

1. For total operating costs of up to 12.5 fils/kg, the grad was ***Efficient.***
2. For total operating cost between 12.6 and 25 fils/kg, the grade was considered ***Medium Efficient.***
3. For total operating cost grater than 25 fils / kg, the grade was considered ***Not Efficient.***

Using those classifications and using the operating costs determined in a previous section, the surveyed semi-automatic washers are classified as shown in Table 22. As can be seen in the Table, 57% of the surveyed models are Not Efficient.

Table 22. Ratings for Surveyed Automatic Washers

Efficient	Medium Efficient	Not Efficient
AEG LL1800	AEG 16810	Haier
AEG LL1600	Bosch WFD2061ME	WD-13150(5)FB
Indesit W84TX	Arsiton	WD-12150(5)FB
AEG 88730	Indesit W431TX	WD-11150(5)FB
AEG 86741	Haier-HG-800E	WD-10150(5)FB
AEG 76730	Arsiton-900	WD-80150(5)FB
Bosch WFO2430AU	Ignis	WD-12160FB
AEG 1459	Arsiton-800	WD-65130F
AEG 1259	Arsiton-500	WD-80130F
Samsong-P1293	Arsiton-600	WD-10130(5)F
Samsong-P1093	Hanseatic	WD(M)-10160(5)F
AEG 1059	WD-1050F	WD(M)-80160F
	WD-8050F	WD(M)-65160F
		General Electric WWH6402
		WD-10120RD
		WD-10125RD
		WD-12120RD
		WD-12125RD
		WD-14120RD
		WD-14125RD
		WD-1485FD
		DAEWOO
		Electa L600TX-F
		Maister
		General Electric WWH7709
		Thomson-1000rpm-F-650
		WD-1374(6)F(H)B
		WD-1274(6)F(H)B
		WD-1174(6)F(H)B
		WD-1074(6)F(H)B
		WD-8074F(H)B
		WD-8078FHB
		WD-1078FHB
12 models (21%)	**13 models (22%)**	**33 models (57%)**

6.5.3 Dishwashing Machines

Dishwashing machines are classified into three grades:

1. For total operating cost up to 55 fils/cycle, the grade was considered is ***Efficient.***
2. For total operating cost between 55 and 80 fils/cycle, the grade was considered ***Medium Efficient.***
3. For total operating cost grater than 80 fils / cycle, the grade was considered ***Not Efficient.***

Using those classifications and using the operating costs determined in a previous section, the surveyed semi-automatic washers are classified as shown in Table 23. As can be seen in the Table, 30% of the surveyed models are inefficient.

Table 23. Ratings for Surveyed Dishwashers

Efficient	Medium Efficient	Not Efficient
AEG 80800/12 sets	AEG 40730/12 sets	SINSER SWQP12-AFM/12 sets
AEG 6820/12 sets	Indesit T62SI/12 set	Bosch CGS3312EU/12 sets
AEG 6081/12 sets	CANDY CD602S/12 sets	Bosch CGS6952/12 sets
	CANDY CD675SA/12 sets	
3 models (30%)	**4 models (40%)**	**3 models (30%)**

6.5.4 Water Heaters

For comparison purposes, it was assumed that water heaters were used to heat water to a temperature of 55 ^{o}C. Accordingly, water heaters were classified into three grades:

1. For total operating cost up to 1.7 fils / L, the grade was considered E***fficient.***
2. For total operating cost between 1.7 and 2.5 fils / L, the grad was considered ***Medium Efficient.***
3. For total operating cost grater than 2.5 fils / L, the grad was considered ***Not Efficient.***

Using those classifications and using the operating costs determined in a previous section, the surveyed heaters are classified as shown in Table 24. As can be seen in the Table, 75% of the surveyed models are of medium efficiency or not efficient.

Table 24. Ratings for Surveyed Water Heaters

Efficient	Medium Efficient	Not Efficient
Ariston-80L	Ariston-50L	Ariston-100L
Sdec-80L	Sdec-50L	Sdec-100L
AOPLLO 4-80L	AOPLLO 4-10L	AOPLLO 4-100L
	AOPLLO 4-20L	
	AOPLLO 4-30L	
	AOPLLO 4-50L	
3 models (25%)	**6 models (50%)**	**6 models (25%)**

6.5.5 Toilets

It was assumed that the toilet is used two times /capita/day in a six person household with a billing cycle of 90 day. Toilets were classified into three grades:

1. For total operating cost up to 1000 fils / cycle, the grade was considered **E*fficient*.**
2. For total operating cost falls between 1000 and 1750 fils / cycle, the grade was considered **M*edium Efficient*.**
3. For total operating cost grater than 1750 fils / cycle, the grad the grade was considered ***Not Efficient.***

Using those classifications and using the operating costs determined in a previous section, the surveyed toilets are classified as shown in Table 25. As can be seen in the Table, only 10% of the surveyed models are inefficient; an indication of the effectiveness of water efficiency programs such as WEPIA. Although the survey is not a comprehensive nationwide survey, it does give an indication of porcelain importers improved awareness on the importance of water efficiency. The popularity of an item is indicative of the consumers' demand drive, which in this case also indicates the increase on demand for efficient toilets.

Table 25. Ratings for Surveyed Toilets

Efficient	Medium Efficient	Not Efficient
Jordan 2-L	Germany (T-7L)	Pakistan
France DF	UK (T-7L)	Portugal 15-L
Italy DF-3.5 L	Jordan 9-L	China 5-L
Germany DF	Italy 9-L	
Italy DF-4.5 L	Germany (T-9L)	
Portugal 5-L	UK (T-9L)	
Jordan 5-L	Jordan 10-L	
Egypt 5-L	Italy 10-L	
Turkey	Saudi	
Spain 5-L	India	
China 6-L	Egypt10-L	
Japan	Spain 10-L	
USA		
Spain 6-L		
Germany		
Palestine		
16 models (51%)	**12 models (39%)**	**3 models (10%)**

6.6 Cross Comparisons

As seen in the proceeding sections, there are some significant differences in the operational costs for the various appliances covered in this survey. The "Medium Efficient" and "Not Efficient" appliances sometimes exceeded 50% of the surveyed models. This translates into increased costs associated with their use. Figure 8 depicts the percentage of savings in operating cost for the household appliances

when the using the "Medium Efficient" and the "Efficient" appliances over the "Not Efficient" ones. As can be seen in the Figure, the non-utilization of the "Not Efficient" appliances can results in savings of up to 60%, 31%, 24%, 34%, and 62% for Toilets, Water Heaters, Dishwashers, Automatic Washers, and Semi-Automatic Washers, respectively.

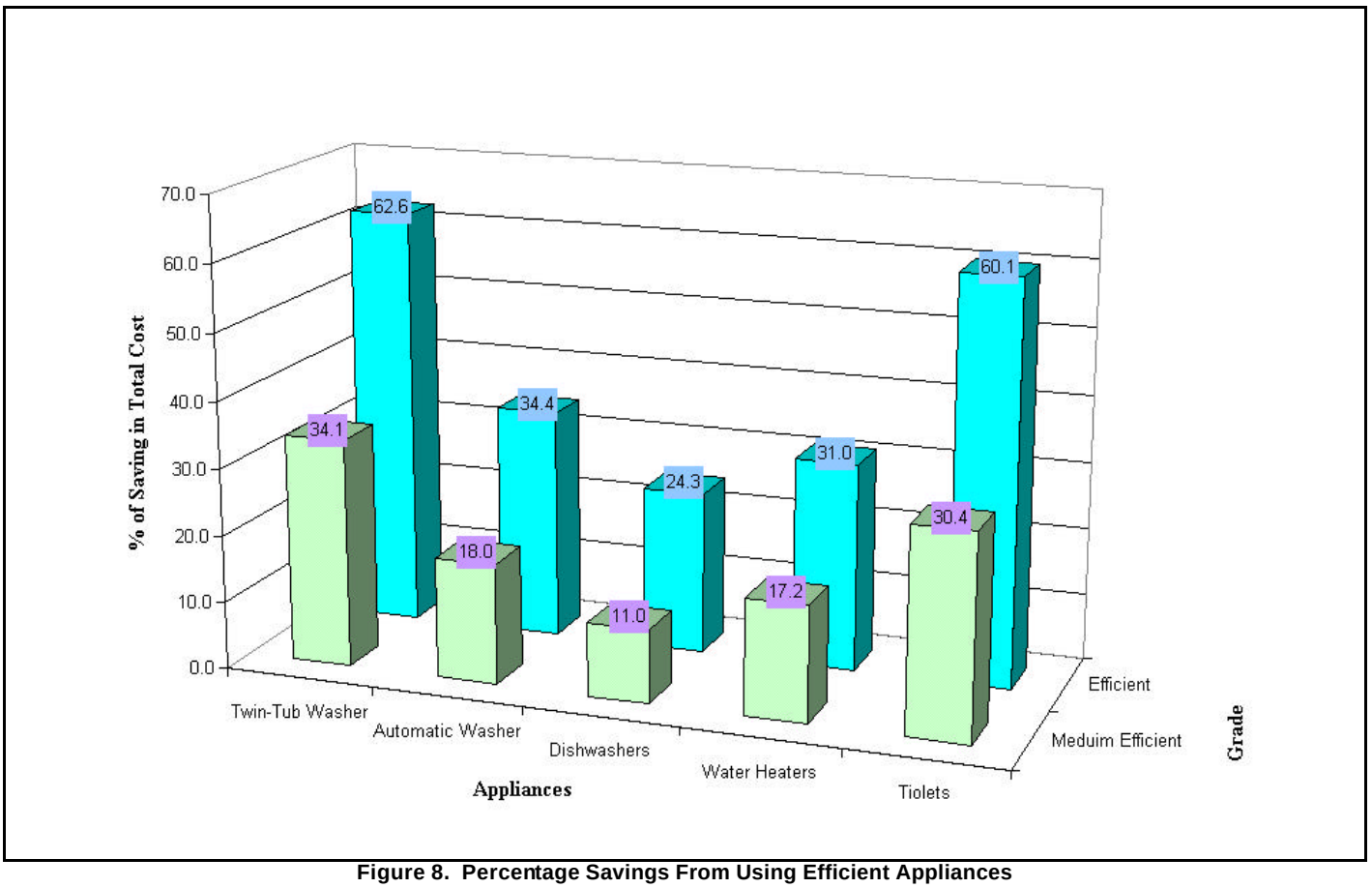


Figure 8. Percentage Savings From Using Efficient Appliances

6.7 Financial Analyses

Although the aforementioned ratings according to the per unit operational costs give an indication of the various efficiencies for the various appliances, it necessary to look at the holistic picture from a consumer's perspective. This is so because sometimes the cost of a more efficient appliance can be higher than that for a less efficient one. It is therefore, necessary to look at the combined cost of purchasing and operating a certain appliance. Tables 26 through 30 present initial cost data versus the ratings that were obtained as indicated in the previous sections.

Table 26. Rating Vs Initial Cost for Semi-Automatic Washers

Type and Model	Rating according to Fils/Kg	Initial Cost(JD)
DAEWOO-7kg	E	80
ROYAL -DW 250	E	90
General Pack	E	90
LG-WP-610NP	N	90
LG-WP-620NP	N	90
LG-WP-680NP	N	90
LG-WP-730NP	N	100
LG-WP-780NP	N	100
Aman	M	125
AMAN- XPB82-388S	M	125
National Electric	M	160
LG-WP-1300QP	M	185
LG-WP-1310QP	M	185
Hetachi-PS950AP	N	220
Hetachi-PS960AP	N	220
Hetachi-PS970AP	N	220
Hetachi-PS980AP	N	220
Hetachi-PS990AP	E	290
White Westinghouse MWS939ZA	N	450

As can be seen in the Tables, although the more efficient appliances may be less costly to operate, they may be more expensive to purchase. Moreover, the savings in operation may not always be high enough (as a proportion of the initial cost) to economically justify the purchase of the more expensive appliance over its projected lifetime, since the recovery period may be too long, and sometimes exceed the life of the appliance itself. However, policies promoting the purchase of the more efficient appliances, will drive manufacturers of less efficient products to modify their products. Although this may drive the prices up initially, an abundance of efficient appliances will eventually drive the prices down as per the theories of economics and due to competition. As long as no restrictions are applied on the manufacturers of low efficiency products, the general tendency will be to purchase such appliances, thus, increase the inefficient consumption of water and electricity.

Table 27. Rating Vs Initial Cost for Automatic Washers

Type and Model	Rating according to Fils/Kg	Initial Cost(JD)
Haier-HG-800E	M	225
WD-1050F	M	270
WD-8050F	M	270
WD-65130F	N	270
WD-80130F	N	270
WD-10130(5)F	N	270
WD(M)-10160(5)F	N	270
WD(M)-80160F	N	270
WD(M)-65160F	N	270
WD-13150(5)FB	N	300
WD-12150(5)FB	N	300
WD-11150(5)FB	N	300
WD-10150(5)FB	N	300
WD-80150(5)FB	N	300
WD-12160FB	N	300
Arsiton-500	M	330
Arsiton-600	M	350
Samsong-P1293	E	370
Samsong-P1093	E	370
Arsiton-800	M	370
Indesit W84TX	E	380
Arsiton-900	M	390
Electa L600TX-F	N	390
Ignis	M	400
Thomson-1000rpm-F-650	N	400
Bosch WFD2061ME	M	425
WD-10120RD	N	425
WD-10125RD	N	425
WD-12120RD	N	425
WD-12125RD	N	425
WD-14120RD	N	425
WD-14125RD	N	425
WD-1485FD	N	425
Maister	N	425
Arsiton	M	450
Indesit W431TX	M	450
General Electric WWH6402	N	470
Bosch WFO2430AU	E	550
General Electric WWH7709	N	560
AEG LL1800	E	620
AEG LL1600	E	620
AEG 88730	E	620
AEG 86741	E	620
AEG 76730	E	620
AEG 1459	E	620
AEG 1259	E	620
AEG 1059	E	620
AEG 16810	M	650

Table 28. Rating Vs Initial Cost for Dish Washers

Type and Model	Rating according to Fils/Cycle	Initial Cost
Indesit T62SI/12 set	M	440
CANDY CD602S/12 sets	M	500
CANDY CD675SA/12 sets	M	500
SINSER SWQP12-AFM/12 sets	N	525
AEG 80800/12 sets	E	600
AEG 6820/12 sets	E	600
AEG 6081/12 sets	E	600
AEG 40730/12 sets	M	600
Bosch CGS3312EU/12 sets	N	650
Bosch CGS6952/12 sets	N	650

Table 29. Rating Vs Initial Cost for Water Heaters

Type and Model	Rating according to Fils/L	Initial Cost(JD)
Egyptian-AOPLLO 4-10L	M	20
Egyptian-AOPLLO 4-20L	M	25
Egyptian-AOPLLO 4-30L	M	35
Italy -Ariston-50L	M	60
Italy -Sdec-50L	M	60
Egyptian-AOPLLO 4-50L	M	45
Italy -Ariston-80L	E	75
Italy -Sdec-80L	E	75
Egyptian-AOPLLO 4-80L	E	55
Italy -Ariston-100L	N	90
Italy -Sdec-100L	N	90
Egyptian-AOPLLO 4-100L	N	65

Table 30. Rating Vs Initial Cost for Toilets

Type and Model	Rating according to Fils/Quarter	Initial Cost(JD)
Jordan-2.3L	E	28
Jordan-5L	E	35
Jordan-9L	M	40
Turkey-5L	E	45
Palestine (T)-6L	E	45
Jordan-10L	M	45
China-15L	N	45
Egypt-5L	E	50
UK(T)-7L	M	50
Spain-6L	E	55
Pakistan-15L	N	55
China-6L	E	60
Japan-6L	E	60
UK(T)-9L	M	60
India-10L	M	60
Egypt-10L	M	60
Portugal-5L	E	65
Spain-5L	E	70
Spain-10L	M	70
Portugal-15L	N	75
Saudi Arabia-10L	M	80
Germany (T)-7L	M	95
Italy-9L	M	100
Italy-10L	M	100
Germany-6L	E	105
Germany (T)-9L	M	110
U.S.A-6L	E	120
France(dual flush)-3L	E	130
Germany(dual flush)-3.5L	E	145
Italy(dual flush)-3.5L	E	150
Italy(dual flush)-4.5L	E	165

7.0 CONCLUSIONS AND RECOMMENDATIONS

Although not a comprehensive labeling assessment, the approach of the survey at hand resembles labeling assessments conducted worldwide. Had the study team had a governmental umbrella in the process of obtaining data from the public and private sectors, more comprehensive and representative results would have been obtained. The occasional non-cooperation of the public and private sectors created some barriers in the data collection process, and lengthened an otherwise straight forward survey. The non-cooperation of the Bureau Veritas was the most stunning to the study team, since the objectives of the Bureau Veritas are in line with the objectives of this survey.

Generally, the survey revealed that there is a wide range of brands and models, of the appliances studied, available to the Jordanian consumers. Furthermore, this range included a variety of efficient and non-efficient appliances. In other words, the Jordanian potential buyer does have the option of selecting an efficient appliance shall s/he be presented with results of local studies similar to this one. The actual consumer behavior, however, was difficult to assess in this study. This is simply because the majority of interviewed importers declined to furnish any data related to their sales volumes. To make things worst, and although not always the case, the less efficient appliances had a tendency of being less expensive, which is the trend, worldwide. This in a way triggers consumers to purchase the less efficient brands and models. So, the consumers' negligence of the wide potential differences between models (in terms of operational cost) coupled with cost issues often drives a potential buyer to select the less expensive appliance.

The study at hand has shown that efficient appliances are available in the Jordanian markets, and in a wide variety. It is the government's responsibility to make consumers aware of this, in order to promote the purchase of more efficient appliances, thus encourage manufacturers and importers to become more selective about the efficiency of their products.

The study team makes the following recommendations

- That the government adopt a similar survey on a larger scale where ALL data are obtained from the public and private sources, including sales volumes. To do so, the government would have to coordinate with the importers to furnish sound and comprehensive technical and financial details about their products. Any programs adopted by the government should include all types of electric appliances and not only the ones addressed in this study.
- The Government MUST establish a Public-Private sector partnership to promote the labeling concept. The success of the US Energy Star program lies in the strong public-private partnership. Potential partners include universities, NGOs, professional associations, Royal Scientific Society, etc.
- The Jordan Ministry of Water and Irrigation and the Ministry of Energy should adopt this program in cooperation with various public and private entities as mentioned above.
- It is recommended that once in its advanced stages, the Government of Jordan (GoJ), via the aforementioned ministries, can implement an appliances certification program.

- An effective NGO or a project similar to Bureau Veritas should be charged with the maintenance of a continuous labeling program that includes all electric appliances available in the Jordanian markets. Such a program would have to be updated annually.
- The success of a star labeling program is extremely dependant on the public delivery mechanism. In other words, if the potential consumers are not aware of the findings of those programs, their decisions to buy efficient appliances will not be promoted. There has to be a regular update of the available products and a regular mechanism to make the public aware of those products.
- The deployment of a mandatory labeling program can be a little hard due to some legislative constraints. However, if a voluntary program is promoted well, and an effective public delivery mechanism deployed, it will promote consumers to purchase the most efficient appliances, which will indirectly promote importers and manufacturers to improve their products to become certified by the labeling program.
- The government should launch a reward program whereby the most efficient appliances are recognized and promoted by the government. This would help encourage manufacturers and importers to manufacture/import the most efficient appliances. This has another advantage of reducing the cost to the consumer if only efficient appliances become available. Such a program should be accompanied by ongoing educational and awareness campaigns to keep the consumers informed of the most efficient appliances.
- The government can gradually implement a structured customs tariff where appliances with higher efficiency ratings receive certain exemptions. Over time, this will help diminish the import of inefficient appliances.

8.0 IMMEDIATE ACTION

As mentioned before, the deployment of a labeling program is a lengthy process that requires years of planning and coordination with different sectors and entities. Although the survey at hand is NOT a labeling program, it has clarified the following issues:

- There is a wide variety of appliances in Jordan in terms of water and energy consumption efficiency,
- In certain instances, there are some large differences in the operating cost of some appliances, thus, indicating significant potential savings shall an official labeling program be adopted and enforced by the GoJ,
- There is a general sense of ignorance as to the operation cost of electric appliances even among appliances importers, which means that the general public is not aware of those differences between the various products,
- The costs of operating the majority of brands for the electric appliances under study that are available in Jordanian markets were quantified. Those, however, were calculated under normalized conditions (e.g., daily use and using the white wash cycle) and do not reflect the actual operation costs under the varying conditions at homes.

The significance of this study is that it is the first study in Jordan to actually quantify operating costs of the various appliances and categorize them. Although a significant amount of work is needed on behalf of the GoJ to arrive at a comprehensive labeling program similar to those in developed countries, the results of this study should be utilized in promoting awareness among Jordanians. For this purpose, the study team recommends that an "Appliance Label" be developed and used to promote awareness. The purpose of the label would be to familiarize potential Jordanian consumers of the concepts of energy and water efficiency, and the differences in efficiencies for the various brands.

As a minimum, it is recommended that the said label for the different appliances include the following:

- Brand name
- Type of appliance
- A scale showing the overall range of the power consumption for the available brands
- A scale showing the overall range of the water consumption for the available brands
- An indication of the particular product's standing with respect to the two scales above,
- An indication of the particular product's annual operating cost,
- Name of authority responsible for the issuance and updating of those figures (e.g., Ministry of Energy, Royal Scientific Society, etc.)

The issuance of the label as per the above recommendations will require that a formal labeling program be adopted by the GoJ. Until then, the study team recommends that the WEPIA project coordinate with the Consumer Protection Agency to issue a simpler general interim label that can be distributed to the importers and dealers of the brands that were found to be efficient in this survey. The label could be similar to previous stickers and labels that WEPIA has produced to promote the use of Water Saving Devices and would give an indication to the potential consumer that this product is one of the most efficient products available on the Jordanian markets. A rough schematic of such label is shown in Figure 9 below. The study team recommends that the "Abu Tawfeer" character developed by the WEPIA project be utilized due to Jordanians' familiarity with it.

It would be the Consumer Protection Agency's responsibility, however, to guarantee that only appliances identified as efficient in this study be authorized to use such label.

An efficiency Slogan (e.g., “Make Sure you Buy Water and Power Efficient Appliances”		
An image of Abu Tawfeer	A statement indicating that this product (washer, dishwasher, heater) is one of the most efficient appliances on the local markets.	Image of appliance (e.g., washer)
WEPIA LOGO	Consumer Protection Agency LOGO	

Figure 9. General Proposed Content of Interim Label